

## 5.3.3 DETENTION VAULTS

*Detention vaults* are box-shaped underground storage facilities typically constructed with reinforced concrete. A standard detention vault detail is shown in Figure 5.3.3.A (p. 5-37). Control structure details are shown in Section 5.3.4 beginning on page 5-38.

### 5.3.3.1 DESIGN CRITERIA

#### General

1. Detention vaults shall be designed as **flow-through systems** with bottoms level (longitudinally) or sloped toward the inlet to facilitate sediment removal. Distance between the inlet and outlet shall be maximized (as feasible).
2. The detention **vault bottom** shall slope at least 5% from each side towards the center, forming a broad "v" to facilitate sediment removal. *Note: More than one "v" may be used to minimize vault depth.*  
**Exception:** The vault bottom may be flat if **removable panels** are provided over the entire vault. Removable panels shall be at grade, have stainless steel lifting eyes, and weigh no more than 5 tons per panel.
3. The **invert elevation of the outlet** shall be elevated above the bottom of the vault to provide an average 6 inches of sediment storage over the entire bottom. The outlet must also be elevated a minimum of 2 feet above the orifice to retain oil within the vault.
4. The outflow system and restrictor device shall be designed according to the applicable requirements specified for **control structures** in Section 5.3.4 (p. 5-38).

#### Materials

Minimum 3,000 psi structural reinforced concrete must be used for all detention vaults. All construction joints must be provided with water stops.

#### Structural Stability

All vaults shall meet structural requirements for overburden support and H-20 traffic loading. Vaults located under roadways must meet the live load requirements of the *King County Road Standards*. Cast-in-place wall sections shall be designed as retaining walls. Structural designs for vaults must be stamped by a licensed structural engineer unless otherwise approved by DDES. Vaults shall be placed on stable, well-consolidated native material with suitable bedding. Vaults shall not be allowed in fill slopes, unless analyzed in a geotechnical report for stability and constructability.

#### Access Requirements

1. **Access** consisting of a frame, grate and locking cover shall be provided over the inlet pipe and outlet structure. Access openings shall be positioned a maximum of 50 feet from any location within the vault; additional access points may be required on large vaults. If more than one "v" is provided in the vault floor, access to each "v" must be provided.
2. For vaults with **greater than 1250 square feet of floor area**, a 5' by 10' removable, locking panel shall be provided. Alternatively, a separate access vault may be provided as shown in Figure 5.3.3.A (p. 5-37).
3. For **vaults under roadways**, the removable panel must be located outside the travel lanes. Alternatively, multiple standard locking manhole covers (see KCRS Drawing No. 2-022 and 2-023) may be provided. Spacing of manhole covers shall be 12 feet, measured on center, to facilitate removal of sediment. Ladders and hand-holds need only be provided at the outlet pipe and inlet pipe,

and as needed to meet OSHA confined space requirements. Vaults providing manhole access at 12-foot spacing need not provide corner ventilation pipes as specified in Item 10 below.

4. All **access openings**, except those covered by removable panels, shall have round, solid **locking covers** (see *KCRS* Drawing Nos. 2-022 and 2-023), or 3-foot square, locking diamond plate covers. For raised openings where the depth from the iron cover to the top of the vault exceeds 24 inches, an access structure equivalent to a Type 2 catch basin or Type 1 manhole shall be used (see *KCRS* Drawing Nos. 2-005 and 2-007). The opening in the vault lid need not exceed 24 inches in diameter.
5. Vaults with widths 10 feet or less must have **removable lids**.
6. The **maximum depth** from finished grade to the vault invert shall be 20 feet.
7. **Internal structural walls** of large vaults shall be provided with openings sufficient for maintenance access between cells. The openings shall be sized and situated to allow access to the maintenance "v" in the vault floor.
8. The **minimum internal height** shall be 7 feet from the highest point of the vault floor (not sump), and the **minimum width** shall be 4 feet.

**Exceptions:**

- Concrete vaults may be a minimum 3 feet in height and width **if used as tanks** with access manholes at each end, and if the width is no larger than the height.
  - The minimum internal height requirement may be waived for any areas covered by removable panels.
9. **Ventilation pipes** (minimum 12-inch diameter or equivalent) shall be provided in all four corners of vaults to allow for artificial ventilation prior to entry of maintenance personnel into the vault.

### **Access Roads**

Access roads are required to the access panel (if applicable), the control structure, and at least one access point per cell, and they shall be designed and constructed **as specified for detention ponds** in Section 5.3.1 (p. 5-20).

### **Right-of-Way**

Detention vaults to be maintained by King County but not located in King County right-of-way shall be in a tract dedicated to King County. Any tract not abutting public right-of-way will require a 15-foot wide extension of the tract to accommodate an access road to the vault.

### **Setbacks**

Setbacks to tract/easement lines for vaults shall be 5 feet; adjacent building setback lines shall be 10 feet. For privately owned and maintained vaults, building foundations may serve as one or more of the vault walls.

## **5.3.3.2 METHODS OF ANALYSIS**

### **Detention Volume and Outflow**

The volume and outflow design for detention vaults shall be in accordance with the performance requirements in Chapter 1 and the hydrologic analysis and routing/design methods in Chapter 3. Restrictor and orifice design shall be according to Section 5.3.4 (p. 5-38).